

WHAT IS CLAIMED IS:

1. A driving circuit for a vacuum fluorescent display having a filament, a grid electrode and a segment electrode,
5 the driving circuit comprising:
 - a filament driving unit for driving the filament;
 - a grid driving unit for pulse-driving the grid electrode;
 - a segment driving unit for pulse-driving the segment electrode; and
 - 10 a controlling unit for validating or invalidating the output of the filament driving unit at a proper timing.
2. The driving circuit for a vacuum fluorescent display
15 according to claim 1, wherein in case of invalidating the output of the filament driving unit, the controlling unit invalidates the output of the filament driving unit for a time period TW when a voltage is reached at which the grid electrode and the segment electrode are driven
20 by the grid driving unit and the segment driving unit, respectively, and when the time period TW to reach the voltage is shorter than a predetermined time period.
3. The driving circuit for a vacuum fluorescent display
25 according to claim 2, wherein the controlling unit outputs a pulse driving signal for pulse-driving the filament.

4. The driving circuit for a vacuum fluorescent display according to claim 2, wherein during the time period TW shorter than the predetermined time period, the controlling unit fixes the output of the filament driving unit at a predetermined level.

5. The driving circuit for a vacuum fluorescent display according to claim 2, wherein
the driving circuit for a vacuum fluorescent display
enables the output of the filament driving unit to be set invalid when it is at some logic value, the driving circuit receiving from exterior data X that enables the output of the filament driving unit to be set valid when it is at another logic value, and wherein
the controlling unit:

sets the output of the filament driving unit invalid for the time period TW that is shorter than the predetermined time period when the data X received from the exterior is at the some logic value; and
sets the output of the filament driving unit valid when the data X received from the exterior is at the other logic value.

6. The driving circuit for a vacuum fluorescent display according to claim 5, wherein
the driving circuit for a vacuum fluorescent display receives from an exterior data Y correlated with the duty

ratio of the output of the grid driving unit or the output of the segment driving unit, and wherein

the time period TW is a time period of the pulse width based on the duty ratio corresponding to the received
5 data Y.

7. The driving circuit for a vacuum fluorescent display according to claim 2, wherein

the driving circuit for a vacuum fluorescent display
10 receives from exterior data Y correlated with the duty ratio of the output of the grid driving unit or the output of the segment driving unit, and wherein

the controlling unit invalidates the output of the filament driving unit for the time period TW when the
15 time period TW based on the duty ratio corresponding to the received data Y is equal to or shorter than a predetermined time period.

8. The driving circuit for a vacuum fluorescent display
20 according to claim 2, wherein the driving circuit for a vacuum fluorescent display is a semiconductor integrated circuit, the driving circuit enabling a switching element that generates a voltage for pulse-driving the filament to be connected to exterior
25 based on the output of the filament driving unit.

9. The driving circuit for a vacuum fluorescent display

according to claim 2, comprising a switching element that generates a voltage for pulse-driving the filament based on the output of the filament driving unit.

5 10. The driving circuit for a vacuum fluorescent display according to claim 9, wherein the driving circuit for a vacuum fluorescent display is a semiconductor integrated circuit, the driving circuit enabling the switching element to be connected to exterior.

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11. The driving circuit for a vacuum fluorescent display according to claim 9, wherein the driving circuit for a vacuum fluorescent display is a semiconductor integrated circuit integrated with the switching elements.

15 12. The driving circuit for a vacuum fluorescent display according to claim 1, wherein when validating the output of the filament driving unit, the controlling unit enables a pulse width and/or a pulse cycle of a pulse driving signal for pulse-driving the filament to be set based 20 on data received from exterior

25 13. The driving circuit for a vacuum fluorescent display according to claim 12, wherein the data received from exterior includes pulse width data for setting the pulse width of the pulse driving signal, and wherein

the controlling unit generates the pulse driving signal having a pulse width corresponding to the received pulse width data.

5 14. The driving circuit for a vacuum fluorescent display according to claim 12, wherein the data received from exterior includes pulse cycle data for setting the pulse cycle of the pulse driving signal, and wherein

10 the controlling unit generates the pulse driving signal having a pulse cycle corresponding to the received pulse cycle data.

15. The driving circuit for a vacuum fluorescent display according to claim 12, wherein the data received from exterior includes pulse width data for setting the pulse width of the pulse driving signal and pulse cycle data for setting the pulse cycle of the pulse driving signal, and wherein

20 the controlling unit sets the pulse width and/or the pulse cycle of the pulse driving signal by putting the pulse driving signal at one level for a time period of the pulse width corresponding to the received pulse width data, and by putting the pulse driving signal at another level for a time period other than the pulse width
25 among the pulse cycles corresponding to the received pulse cycle data.

16. The driving circuit for a vacuum fluorescent display according to claim 15, wherein the filament pulse controlling unit comprises:

a first comparing unit for comparing the pulse width
5 data with a count value based on a reference clock signal;

a second comparing unit for comparing the pulse cycle data with a count value based on a reference clock signal;

a counting unit for generating the count value by dividing as predetermined the reference clock signal as
10 well as resetting the count value when the result of the comparison at the first comparing unit or the second comparing unit shows coincidence; and

a controlling unit for putting the pulse driving signal at one level when the result of the comparison
15 at the first comparing unit shows coincidence, and for putting the pulse driving signal at the other level when the result of the comparison at the second comparing unit shows coincidence.

20 17. The driving circuit for a vacuum fluorescent display according to claim 12, wherein the driving circuit for a vacuum fluorescent display is a semiconductor integrated circuit, the driving unit enabling the switching element that generates a voltage for
25 pulse-driving the filament based on the pulse driving signal to be connected to the exterior.

18. The driving circuit for a vacuum fluorescent display according to claim 12, wherein the driving circuit for a vacuum fluorescent display comprises a switching element that generates a voltage for pulse-driving the filament based on the pulse driving signal.
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19. The driving circuit for a vacuum fluorescent display according to claim 18, wherein the driving circuit for a vacuum fluorescent display is a semiconductor integrated circuit, the driving circuit enabling the switching element to be connected to exterior.
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20. The driving circuit for a vacuum fluorescent display according to claim 18, wherein the driving circuit for a vacuum fluorescent display is a semiconductor integrated circuit integrated with the switching element.
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